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RESTORATION OF THE TONIUM WAVE RESEARCH STATION AT THE PORT OF TUAPSE

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The operation of marine hydrotechnical installations and the heavy damage of port installations that has occurred in the past (Algiers, Catania, Tunes, and other ports) brings about the necessity of studying the action of the sea swell on installations and the influence of the swell on the operational conditions of ports.

These problems must be solved by marine hydrotechnical stations similar to those in the ports of Genoa, Havre, Dieppe, Algiers, Heligoland.

The basic factor determining the dimensions, durability, and efficiency of the construction of breakwaters is the wave load.

The variety of existing methods of determining the wave load on parts of sea breakwaters frequently results in the fact that it is extremely difficult to make a correct selection of the calculated magnitude. A test of the existing methods of calculation by observation and measurement of the elements of the wave and the force of its action on installations by specially organized wave research stations will contribute toward the removal of this defect.

The necessity of studying the action of the swell on installations made it imperative to restore the wave station in the port of Tuapse which was destroyed as a result of damage by the tanker "Asneft" in 1937, and to construct a marine hydrotechnical station, designed in 1936, in the port of Sochi.

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In execution of Order No 227 of the Ministry of the Maritime Fleet, 25 May 1946, on "The Work of TsNIIMF and the State of Scientific Work on Marine Transportation," the author developed a project to restore and equip the experimental wave station in the port of Tuapse. While carrying out the basic work of designing the wave station, equipment, instruments, and methods of observing the swell, the methods of studying the sea swell for the purpose of port installations and the problems of swell stations were determined. The operational experience of wave stations at Yalta, Poti, and Tuapse for 1934-37 was studied, and the principal designs of instruments to measure and register the wave pressure and elements of a wave were selected as the basis upon which the design of the station equipment was worked out.

The wave station was built in the superstructure of the southwestern breakwater of the port of Tuapse and is a two-story compartment between the ± 0.7 and ± 5.5 meter marks (see appended figure). The dimensions of the compartment in the plan are 1.8×2.25 meters. The stories are 2.0 meters high. Metal boxes for the instruments were installed in the side walls of the station (the body of the superstructure). The external wall of the station which faces the sea is 1.0 meters thick. Openings are provided at the 1.2, 2.2, 3.2, 4.2, and 5.0 meter marks above sea level in the external wall of the compartment of the station for installation of the instruments which receive the wave load, the so-called transmitting elements of wave pressure.

Under water at marks 0.0, -1.0, -2.0, -3.0, -4.0, underwater transmitting elements were mounted on a special panel of channel iron No 22, and installed in supporting sockets at the -5 meter mark on the external edge without the help of divers. The upper end of the panel above the water was fastened to the wall with anchor bolts and clamps.

An electrical contact wave recorder was installed on the external edge of the breakwater to measure the variations in the level of the water at the wall of the breakwater during a swell. The contact couple of an automatic starter was also installed.

On the external side of the breakwater a structure was provided for the installation of a very simple temporary lifting apparatus in the form of booms with a system of blocks.

Cables from the devices enter the compartment of the station through special openings which are supplied with packing and junction boxes.

All recording instruments and equipment are located in the compartment of the station.

The equipment of the wave station consists of the following instruments and devices:

1. Ten transmitting elements which receive the wave load
2. Two recorders of the wave pressure at 10 points (5 points each)
3. Electric-contact wave recorder in three sections with 18 contact couples installed 0.5 meter apart
4. Contact couple of an automatic starter

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5. Automatic starter
6. Storage battery
7. Inverter to produce alternating current to feed the transmitting elements
8. Auxiliary control-measuring devices
9. Calibrating devices and accessories necessary for operation of instruments and equipment

Basic information and characteristics of the principles of the devices, a description of the construction of the equipment, and information on the operation of the devices follows.

Wave pressure on the structure is registered by means of induction transmitting elements which operate on alternating current. Dimensions of the transmitting element are: diameter of the membrane, 150 mm; depth, 80 mm. The transmitting element is connected with a recorder by a three-wire cable.

The transmitting elements are supplied with a differential transformer for adjustment to the expected wave load.

A fluctuating direct current milliammeter measures the transmitting elements' indications of the wave pressure. The needles of the milliammeter are supplied with "feathers" in the form of tungsten tips.

Indication of the transmitting elements and the electrode contact wave recorder are registered by an electric recorder, which is based on the passage of a high-voltage electric spark through a moving paper tape. Each device registers the reading of five pressure indicators, the reading of the electric contact wave recorder, the astro-nomic time of starting the station, and a notation of the time at one-second intervals.

Successive short circuiting of the contact couples, which are installed vertically at 0.5 meter intervals from the -3 mark to the +5.5 mark on the No 12 channel iron panels, by the crest of the wave registers the pressure and measures the height of the wave at the wall.

To avoid accidental short circuiting, the contact couples are protected by a cover with lateral openings for water to flow through during flooding by the crest of the wave.

Storage batteries that are charged ashore are the source of current of the electric devices and equipment. An inverter in the station transforms the direct current into alternating current.

An automatic starter starts and stops all the devices of the station. An automatic starter turns on all the devices of the station when the crest of the wave reaches the +1.5 meter mark, where a contact couple of the automatic starter has been installed. The periodicity of the work of the station can be changed from 1 to 4 hours. The devices operate for 5 minutes after each starting. The station is continuously connected for 5 minute intervals as long as the crest of the wave reaches the +1.5 meter mark.

It is planned to measure the elements of the waves at a distance

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